National Transportation Safety Board **FACTUAL REPORT** **AVIATION**	NTSB ID: CHI07MA083	Aircraft Registration Number: N911VC
	Occurrence Date: 03/11/2007	Most Critical Injury: Fatal
	Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
Haena	HI	96713	1259	HST	

Airport Proximity: Off Airport/Airstrip	Distance From Landing Facility:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
McDonnell Douglas	369FF	Helicopter

Revenue Sightseeing Flight: Yes

Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

HISTORY OF FLIGHT

On March 11, 2007, at 1259 Hawaiian Standard Time, a McDonnell Douglas (MD) 369FF helicopter, N911VC, operated by Smoky Mountain Helicopters and doing business as Inter-Island Helicopters Inc., sustained substantial damage when it impacted trees and terrain in the town of Haena on the island of Kauai, Hawaii, during a Part 135 commercial air tour flight. The flight departed from the Port Allen Airport (PAK), Hanapepe, Hawaii, on a 55-minute sightseeing tour of Kauai. During cruise flight near Tunnel Beach in Haena, the tail rotor output shaft and the tail rotor blades separated from the tail rotor gearbox and fell into the ocean. The pilot executed an autorotation to a YMCA campground that was located next to the beach. The pilot received minor injuries; however, the right front seat passenger was killed, and the three other passengers received serious injuries. Visual meteorological conditions prevailed and a company flight plan was in effect.

The pilot stated that he reported for duty one hour prior to his first flight of the day that was scheduled for 0800. He conducted a thorough preflight of the aircraft that included an inspection of the tail rotor section. The fluid levels were normal and there were no signs of cracks, dings, or delamination of the surface and leading edges of the tail rotor blades. The pitch change links were in good condition and no loose bearings were noted. He reported that the tail rotor gearbox housing appeared to be in good condition and no cracks were observed. He checked the nuts that hold the tail rotor section in place. The torque seal was visible on each nut, and he physically checked each one to determine if they were tight. The bellcrank was not cracked, the nuts were tight, and the cotter pins were in place.

The pilot reported that the first two flights of the day, the first at 0800 and the second at 1005, were "waterfall" flights. During the waterfall flights, he flew to a private landing zone located near a waterfall. While in the landing zone, he shut the helicopter down while the passengers visited the waterfall for about 45 minutes. He reported that he conducted a post flight inspection "as we always do." He checked the fluid levels of the engine, main rotor transmission, and the tail rotor gearbox. The fluid levels were normal and no leaks were noted. He checked the main rotor and tail rotor blades for cracks, dings, and delamination of the surface and leading edges of the blades. During both flights, the helicopter operated normally and no abnormal vibrations were noted.

The third flight was a 50 to 55-minute island tour that departed about 1210. The pilot reported, "I viewed the passengers that got on board, jackets were on, zipped up and secured, life jacket pouches were on and secured, cameras were secured, and they had no hats or bags with them."

He reported that during the accident flight he felt no abnormal vibrations in the controls. About halfway through the flight, he was flying over Tunnel Beach, about 50 yards from the shoreline, at 1,000 feet above ground level (agl) with 80 - 85 knots of airspeed. Within a split-second, he

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heard two loud "bangs" and he "felt it" in his seat and pedals. The nose of the helicopter pitched down, and the helicopter yawed to the right. He applied left pedal but without effect. He attempted to "get more forward airspeed," but each time he did the helicopter nosed over and yawed to the right. The right yaw developed into a tight spin, and he realized that he "lost his tail rotor." He adjusted the collective and throttle to get the "yaw under control," and reported that, "it did slow down the yaw a little."

He recognized the YMCA campground and decided to execute an autorotation to the open field at the campground. He entered the autorotation by rolling off the throttle and lowering the collective. He reported the "right yaw slowed even more." He attempted to gain airspeed and he "followed the right yaw," which made the spin slower, as he approached the campground. When the helicopter was about five feet agl, he pulled the collective up to cushion the landing. After the helicopter impacted the terrain, he checked the condition of each passenger, and then secured the engine by turning the master switch off and pulling the fuel shutoff. He took the fire extinguisher and exited the helicopter. He saw that the tail rotor blades and output shaft had separated from the tail rotor gearbox.

Local citizens arrived at the accident site almost immediately to provide assistance to the pilot and passengers. Within minutes, the local police and fire department personnel were on site.

There were numerous witnesses to the accident. One witness reported that she heard a loud "pop" and she saw two objects falling into the ocean. The larger object fell into the ocean close to shore. The other object "fell slower in a fluttering action." She reported that both objects fell into the ocean where the waves were breaking and the reef ended.

Another witness heard a "pop" and observed the helicopter spiraling down. She reported, "Then the spiral tightened and sped up. The overhead rotor could be seen as blades (not turning). The blue and white body of the copter was turning slowly around the rotor - rather flat - no obvious pitch of the nose up or down. There was a large thud - presumably impact."

A third witness reported that the helicopter "started a slow spiral to the right as it was circling a house" and that the "spiral tightened up and there were two of these tight spirals - the main blades were not turning very rapidly." He reported that at "no time was the nose significantly down. It was a gradual descent but not in a violent down descent. It did a total of 3 spirals - one gradual and the last 2 were more rapid."

The three passengers on board the helicopter were interviewed. They reported that they did not see anything fall out of the helicopter prior to the accident, and they did not observe birds in the area.

PERSONNEL INFORMATION

The pilot was a 30-year-old commercial pilot with helicopter and instrument (helicopter) ratings. He held a second-class medical certificate that was issued in January 2007. He reported a total of 2,041 flight hours with 189 hours in the MD 369FF helicopter.

AIRCRAFT INFORMATION

The helicopter was a MD Helicopter 369FF manufactured in 1987. It was equipped with a turbine-powered Allison 250-C30 engine. At the time of the accident, the total helicopter time was about 7,800.8 flight hours. The most recent airframe inspection was a 100-hour inspection completed on February 28, 2007, at a total airframe time of 7,775.8 hours. The last annual inspection was completed on July 9, 2006, at a total airframe time of 7,098.0 hours. The last inspection of the engine was a 150-hour inspection completed on February 11, 2007, at a Hobbs time of 4,174.2 and an engine time of 7,400.2 hours.

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METEOROLOGICAL CONDITIONS

The observed surface weather at the Lihue Airport, Lihue, Hawaii, located about 17 miles southeast of the accident site, was: Wind 010 at 4 knots, scattered clouds at 2,800 feet, overcast 3,700 feet, temperature 23 degrees Celsius (C), dew point 18 degrees C, altimeter 29.94 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The helicopter impacted the trees and terrain at the western edge of the YMCA campground at coordinates 22 degrees 13.412 minutes north latitude, 159 degrees 33.231 minutes west longitude. The entire helicopter wreckage was located at the impact site, except for the tail rotor output shaft and tail rotor blades. A broken tree limb about 15 - 20 feet above the ground was visible in the trees located next to the wreckage. There was no ground fire.

The inspection of the airframe revealed extensive damage to the fuselage with major damage concentrated at the underside of the lower right and forward fuselage section. There was extensive crushing, tearing, and deformation of fuselage structure and skin panels in that area. The cockpit structure received extensive damage. The cockpit seat support structure and cockpit flooring were distorted and displaced upward. The aft passenger compartment was intact. The bench seat frame was distorted and the left rear attaching point was separated from the fuselage station (FS) 124.9 fuselage frame and the left seat leg had separated from its floor mounting point. The keel beam was intact with some damage to the forward section. There was no visible damage to the mast support structure. The lower section of the fuselage in and around the landing gear attaching points was deformed and buckled. The aft fuselage section was deformed and wrinkled. The composite upper pylon was intact with minor damage to the forward and aft sections. The aft boom fairing was attached with minor visible wrinkling of the skin surfaces. The right landing gear's aft strut was fractured at the mounting flange and the aft strut was separated from the fuselage. The forward strut was still attached and displaced upward and aft. The skid tube was fractured into two pieces at the forward saddle mount. The left landing gear was intact and it remained attached to the airframe. The tailboom was nearly fractured into two segments at about FS 242.12. The main rotor hub assembly and components exhibited minor damage. All five main rotor blades were still attached to the rotor head, and they exhibited bent spars, skin delamination, trailing edge separation, cuts and gouges. The blades were bent upward at varying degrees of 5 - 18 degrees. The main transmission showed no exterior damage and rotated when the main rotor system was turned by hand.

The tail rotor system received extensive damage. The tail rotor gearbox fractured across the case elbow with the aft segment of the case remaining attached to the tailboom extension. The gearbox mounting bolts were in place and secure. There was no visible evidence of tail rotor gearbox movement on the tail boom extension. The tail rotor gearbox input quill rotated when manipulated by hand.

The outer segment of the fractured gearbox, the output shaft with associated bearing sets, the FS 284 bellcrank, the fractured tailboom control rod, the tail rotor pitch change assembly, the drive fork with teetering bearings, and the tail rotor hub and blades, had separated from the helicopter and were not located during the onsite portion of the investigation.

The available section of the fractured tail rotor gearbox was sent to the National Transportation Safety Board's (NTSB) Materials Laboratory for inspection. The initial inspection of the tail rotor gearbox on March 22, 2007, revealed that all the fractures were typical of overstress fractures.

Police scuba divers searched for the tail rotor output shaft and tail rotor blades for two days,

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but were unable to locate the missing parts. High surf conditions prevented divers from continuing the search for the parts. Within weeks of the accident, the missing parts were retrieved from the Tunnels Beech area and were sent to the NTSB Materials Laboratory for inspection.

TESTS AND RESEARCH

The tail rotor blade assembly, the aft portion of the tail boom, the tail boom extension, and the fractured portion of the tail rotor gearbox were inspected at the NTSB Materials Laboratory. The Materials Laboratory reported that the tail rotor blade assembly fractured through the root fitting, P/N 369A1624-3, in the general area that coincided with a hole for the blade retention bolt. The root fitting contained a 1-inch nominal diameter longitudinal hub bore with a tapered (conical) hole bottom. A relief radius was located between the hub bore and the conical hole bottom. A 0.12-inch nominal diameter hole extended below the conical hole bottom. The root fitting also contained a hole for the tail rotor retention bolt (a smaller hole that was oriented perpendicular to the hub bore).

On the top (camber) side of the blade, the fracture extended between the top surface and the relief radius of the hub bore. At the relief radius, the fracture extended around approximately 40 percent of the circumference of the hub bore and intersected the hole for the blade retention bolt. On the opposite side of the retention bolt hole, the fracture extended through to the bottom (non-camber) surface inboard of the relief radius.

Bench binocular microscope examination of the root fitting revealed the fracture face contained radial marks that emanated from the hub bore. Closer examination of the fracture face revealed crack arrest marks typical of a fatigue cracking that emanated from multiple origins at the relief radius between the hub bore and conical hole bottom. The arc length of the multiple origin fatigue crack along the relief radius measured approximately 0.6 inch. The fatigue crack origin area was located adjacent to the top surface of the root fitting and slightly toward the trailing edge. Various areas of the fracture face showed evidence of fatigue crack arrest marks indicating that the fatigue crack propagated toward the exterior top surface, around both sides of the bore, approximately half way around the root fitting cross section, and into the hole for the blade retention bolt. The fatigue crack re-initiated on the opposite side of the hole for the blade retention bolt and propagated as much as 0.3 inch.

A longitudinal-radial section was made through the hub bore, relief radius, and portion of the conical bottom. The section was encased in a metallurgical mount and polished. Examination of the metallurgical section revealed that the relief radius was similar to the size of the machine marks in the bore. The relief radius measured approximately 0.001 inch, much less than specified by the engineering drawing (0.12 inch and 0.15 inch).

ADDITIONAL INFORMATION

On April 26, 2007, McDonnell Helicopters, Inc. (MDHI) issued mandatory Service Bulletin (SB) 369D-204, 369E-099, 369F-084, 369H-247, titled "Tail Rotor Blade Assembly, One Time Inspection." According to MDHI SB, before further flight, the tail rotor should be removed from helicopter models 369 (Army YOH-6A), 369 (Army OH-6A), 369H, 369HM, 369HS, 369HE, 369D, 369E, 369F, and 369FF. The hub bore should be visually examined with a flashlight. If the relief radius does not contain a smooth transition between the bore and conical bottom hole, the root fitting should be removed from service.

On April 27, 2007, the Federal Aviation Administration issued emergency Airworthiness Directive (AD) 2007-09-51 that mandated inspection of the root fittings per the MDHI SB.

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Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
		Ft. MSL	NA		

Runway Surface Type:

Runway Surface Condition:

Approach/Arrival Flown: NONE

VFR Approach/Landing: None

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
McDonnell Douglas	369FF	0049FF

Airworthiness Certificate(s): Normal

Landing Gear Type: Skid

Amateur Built Acft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	5	3100 LBS	1

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Shaft	Allison	250-C30	425 HP

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
100 Hour	02/2007	43 Hours	7799 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?/Type	ELT Operated?	ELT Aided in Locating Accident Site?
Yes /	No	No

Owner/Operator Information

Registered Aircraft Owner	Street Address	City	State	Zip Code
Smoky Mountain Helicopters, Inc.	2979 Barley Mill Rd.	Yorklyn	DE	19736

Operator of Aircraft	Street Address	City	State	Zip Code
Inter-Island Helicopter Inc.	P.O. Box 156	Hanapepe	HI	96716

Operator Does Business As:

Operator Designator Code:

- Type of U.S. Certificate(s) Held:

Air Carrier Operating Certificate(s): On-demand Air Taxi

Operating Certificate:

Operator Certificate:

Regulation Flight Conducted Under: Part 135: Air Taxi & Commuter

Type of Flight Operation Conducted: Non-scheduled; Domestic; Passenger Only

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First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	30

Sex: M | Seat Occupied: Left | Occupational Pilot? | Certificate Number: On File

Certificate(s): Flight Instructor; Commercial

Airplane Rating(s): None

Rotorcraft/Glider/LTA: Helicopter

Instrument Rating(s): Helicopter

Instructor Rating(s): Helicopter

Current Biennial Flight Review? 01/2007

Medical Cert.: Class 2 | Medical Cert. Status: Without Waivers/Limitations | Date of Last Medical Exam: 01/2007

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	2041	189	7		142		70	2035		
Pilot In Command(PIC)	1981	189			142		70	1981		
Instructor										
Instruction Received										
Last 90 Days	248	186						248		
Last 30 Days	71	77						71		
Last 24 Hours	5	5						5		

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? No | Second Pilot? No

Flight Plan/Itinerary

Type of Flight Plan Filed: Company VFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
Hanapepe	HI	PAK	1210	HST

Destination	State	Airport Identifier
Local Flight		

Type of Clearance: None

Type of Airspace:

Weather Information

Source of Wx Information:

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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
PHLI	1153	HST	153 Ft. MSL	17 NM	130 Deg. Mag.

Sky/Lowest Cloud Condition: Scattered 2800 Ft. AGL

Condition of Light: Day

Lowest Ceiling: Overcast 3700 Ft. AGL

Visibility: 8 SM

Altimeter: 29.94 "Hg

Temperature: 23 °C

Dew Point: 18 °C

Weather Conditions at Accident Site: Visual Conditions

Wind Direction: 10

Wind Speed: 4

Wind Gusts:

Visibility (RVR): Ft.

Visibility (RVV) SM

Precip and/or Obscuration:

Light - Rain

Accident Information

Aircraft Damage: Substantial

Aircraft Fire: None

Aircraft Explosion None

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot					
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants					
Other Crew					
Passengers	1	3			4
- TOTAL ABOARD -	1	3		1	5
Other Ground					
- GRAND TOTAL -	1	3		1	5

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Administrative Information

Investigator-In-Charge (IIC)

Jim Silliman

Additional Persons Participating in This Accident/Incident Investigation:

Scott Allen
FAA Honolulu FSDO
Honolulu, HI

Adrian Booth
The Boeing Company
Mesa, AZ

Ken D'Attilio
Inter-Island Helicopters
Hanapepe, HI

Bob Drake
FAA
Washington, DC

Roger Carlin
MD Helicopters
Mesa, AZ